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Process and apparatus for the transverse closing of a packing tube

Process and apparatus for the formation of a closure for a packing material that contains a plastic food, for example spreading cheese, in which the apparatus presents closure elements , which has on its surface a large number of small channels which run laterally to the longitudinal axis of the closure element.

Process and apparatus for the transverse closing of a packing tube

Patent Claims

1. Process for the transverse closing of a packing tube through an interlyng layer of a plastic food, characterized by

   - Preparing of a longitudinally continuous body (502) of the plastic food to be packed, which is surrounded continuously by a packing foil which presents several, at least two layers comprising an inner closure layer with a relatively low melting temperature and with an outer layer not melting at the closing conditions, for the creation of a food packed by means of the foil tube (12),

   - transverse compressing of the foil tube (12) betwen a warmed, transversely grooved closing surface (206) and an elastomer smooth surface (604), in order to move the food (502) out of the zone between the grooved closing surface (206) and the elastomer smooth surface (604) and to close the inner surfaces of the packing material and to reinforce the foil tube (12) at the transverse closure.

2. Process according to claim 1, characterized in that the grooved closing surface (206) has individual separated closing surfaces with a density of at least 7.5 closing surfaces per cm^2, the individual closing surfaces occupying at least 30% of the zone of the grooved closing surfaces (206).

3. Process according to claim 1, characterized in that the finely grooved closing surface presents transverse channels with a density of at least 5.9 transverse channels per cm, the channels having a depth of about 0.127 mm to about 0.508 mm and a width of about 0.254 mm to about 0.762 mm.

4. Process according to claim 2, characterized in that the food is cheese, and that the transverse compressing is carried for one second or less than one second.

5. Apparatus for the execution of the process according to claims 1 to 4, characterized in that the closing element (200) comprises a base body with a composite closing surface (206) which presents several relatively small and closely adjacent transverse channels in it, which communicate with the corresponding sides of the closing element (200) and have a channel density of at least 5.9 channels per cm.

6. Apparatus according to claim 5, characterized in that the composite closing surface (206 has a density of at least 77.5 individual closing surfaces per cm^2.

7. Apparatus according to claim 5, characterized in that the channels have a depth of about 0.127 mm to about 0.598 mm.

8. Apparatus according to claim 7, characterized in that the closing element (200) presents several intersecting series of channels (212, 214).

Process and apparatus for the transverse closing of a packing tu

The invention relates to a process and to an apparatus for the transverse closing of a packing tube through an interlying layer of a plastic food, according to the generic term of claim 1, and relates in particular to a process and to an apparatus for the packing of spreading cheese or the like, in which the process and the apparatus for the closing of the packing material is to be improved by means of compressing the packing material through the plastic food.

In the production of individually packed slices of foods, such as, for example, slices of cheese, a hot viscous cheese compositi is introduced into a packing tube which is formed continuously of a suitable organic polymer packing material, in order to obtain an oblong continuous band of spreading cheese within the packing tube. The packing tube containing the cheese band can successively be transversely closed and severed transversely to the to the longitudinal axis of the tube, in order to obtain individual packed slices of the spreading cheese. In order to make the desired transverse closure for such packings it is necessary to remove the cheese from the transverse closure zone and to bring the oppositely lying inner surfaces of the foil tube adhesively in contact, in order to produce a suitable transverse closure. Such an adhesive contacting was usually carried out by compressing of a packing foil with an inner closure layer with a relatively low melting temperature between an elastomer bearing element and a metal transverse closure strip element, the closure element being heated to a sufficiently high temperature to bring about the

desired adhesion in the counting under the operating conditions, such as the contacting time, the pressure and the temperature.

Substantial difficulties have arisen, however, in the formation of a dependable transverse closure of the packing material through the food. In regard to these difficulties let reference be made to the maintaining of the suitable temperature ranges for the closing without damaging the packing material, or without adhesion of the packing material to the closing elements, the limitations in respect to the type of the packing foil used for such packings, the insufficient removal of the cheese or other food from the closure zone, the formation of socalled tubular leakage channels from a longitudinal folding of the closure zone, the difficulties of a dependable creation of the packing unit and the creation of the package closure which opens unevently if a relatively constant opening pull force is applied by the user. The most diverse attempts to solve these problems, such as, for example, the providing of nonadhesive coatings to the transverse closing elements and the supporting elements, were not completely satisfactory.

Accordingly, it is the problem of the present invention to further develope an apparatus of the type mentioned at the outset in such a manner that a uniform tight closure is formed.

This problem is solved by the invention characterized in claims 1 and 5.

Advantageous developments of the invention are yielded from the subclaims.

With the invention there are created a process and an apparatus for the transverse closing of packing materials through an interlying layer of a viscous or plastic food, such as, for example, spreading cheese. According to the invention an elongated continuous body of the plastic food to be packed is made, which is continuously surrounded by a packing foil. The packing foil comprises several, at least two, layers, comprising an inner closure layer with a relatively low melting temperature and an outer layer not melting under the closing conditions. Such packing foils are used ordinarily for the packing of foods, such as, for example, spreading cheese. Further, the food band wrapped in longitudinal direction is compressed transversely between a finely grooved closing surface and an elastomer smooth surface, in order to move the food out of the zone between the grooved closing surface and the elastomer smooth surfaces and to close the inner surfaces of the packing material.

An important feature of the invention lies in the cooperation of a finely grooved closing surface with an elastomer smooth support surface for the production of a transverse closure in the packing material through the food. In regard to this, the closing

elements are provided with a closing surfaces which comprises several relatively small and closly spaced channels which present a directiona component which runs at a right angle to the longitudinal angle of the closing lement. In this regard channel series can be provided in the surface of the closing element, which have a channel density of at least 5.9 channels per cm in a range of about 7.87 to about 15.75 channels per cm.

The presence of such channels can likewise be regarded as the providing of several corresponding separate direct contact closure surfaces which present at least 5.9 separate closing surfaces between the transversal channels. In particular, preferred forms of execution of the closure system according to the invention present surfaces with intersection series of channels which create a channel network and a corresponding number of separate direct contact surfaces elements. Such series have preferably a discontinuous composite closure surface with at least 77.5 and still preferably at least about 124 separate contact surface elements per cm^2 of the compositite closing surface.

The depth of such channels and their width is likewise important in the creation of sure transverse closures. In this regard the channels should have a depth in a range from about 0.127 mm to about 0.058 mm, and still more preferably about 0.254 mm. The width of the channels lie in a range from about 0.254 mm to about 0.762 mm at the intersection place of the

channels with the closure surface elements formed in between standing in direct contact.

The closure elements can be provided with a closure surface which, by reason of several channels present, is discontinuous. The discontinuous closure surface of the closure element should, however, comprise at least about 30% of the zone of the composite closure surface, inclusive of the channels, and should amount preferably to 40 to 60% of the composite finely grooved closure surface. Correspondingly the channel zone on the closure surface should amount to less than about 70% and preferably about 40 to 60% of the zone of the finely grooved closure surface. Finely grooved closure elements according to the invention can easily be made of suitable metals, metal alloys by usual rolling techniques. Other processes, such as, for example, photomask generation with electrochemical rollers, plasma etching or chemical etching can be used in a similar manner, in order to generate the desired discontinuous surface of the separate closing surfaces standing in direct contact.

It is assumed that the cooperation of the firm finely grooved closing element surfaces with their fine discontinuous closing surfaces and the corresponding number of channels with the elastomer smooth element in the compressing of the elongated wrapped food substantially facilitates the removal of the whole plastic food from the closure zone, whereby it is more easily possible to keep

the foil in a firm, fold-free state, in order thereby to generate uniform dependable closures. The providing of the many separate closure element surfaces serves further for the concentration of the pressure at the separated closure element surface points, whereby there is achieved the sure adhesion of the corresponding inner surfaces of the foil tube at these points. By the providing of the transversely running channels and of the corresponding separate surface elements which are directed angularily with respect to the longitudinal axis of the foil tube there are avoided tubular leakage channels, folds or cracks which otherwise occur preferably in this direction.

An example of execution of the invention is represented in the drawing and is described in detail in the following. In it:

Fig. 1 shows a side view of a form of execution of the apparatus for the formation of the transverse closure of a cheese packing with a finely grooved closing element;

Fig. 2 a perspective view of the finely grooved closing element which is used in the apparatus in Fig. 1;

Fig. 3 a plan view of a part of the closing surface of the closing strip of Fig. 2;

Fig. 4 an enlarged section view of the finely grooved closing element of Fig. 3 along the line IV-IV of Fig. 3;

Fig. 5 an enlarged section view of the finely grooved closing element of Fig. 3 along the line V-V of Fig. 3, in which an interlying packing foil tube, and the cheese band are closed by the operation of the closing element and of the support element; and

Fig. 6 a perspective view of the the apparatus of the elastomer support element used in Fig. 1.

In the drawing, in Fig. 1 there is represented an apparatus for the transverse closing of a packing tube, which has a large number of tiny closing elements 200 provided with transverse channels, which cooperate under pressure with an elastomer support part 600, as it is represented in Fig. 6. Figs. 3 to 6 show enlarged view of the parts of the closing element 200 and of the elastomer support part 600.

As is seen in Fig. 1, a continuous band 12 of cheese packed in longitudinal direction, preferably spreading cheese, which was extruded or in other manner brought in contact with the inner surface of the packing at an elevated temperature (for example, over about 68.33°C), is produced in a usual manner. The enclosed cheese band should preferably stand in continuous contact with the

In Fig. 1 there is represented an apparatus 10 for the transverse closing, which presents a large number of very small clossing elements 200 provided with transverse channels, which in the compressed state lie opposite the elastomer support part 600, as it is represented in Fig. 6. Figs. 3 to 6 show enlarged views of the parts of the closing element 200 and of the elastomer support part 600.

inner surfaces of the packing material, little air spaces being formed essentially in between. In this regard, the spreading cheese or another food is fed in from the usual processing machine at raised temperature and continuously extruded in melted or liquid form into a mold or a plastic envelope, in order to create a continuous band of spreading cheese, which is surrounded by means of the organic polymer envelope.

As represented in Fig. 5, which shows a section view of the wrapped cheese band 12 along the transverse closure direction, the enclosed cheese band 502 stands in direct intimate contact with the surrounding packing material 504. The enclosed cheese band 504 (sic) can preferably have a thickness in the range from about 0.254 cm to about 0.762 cm and has a width in the range from about 5.08 to about 12.7 cm. Typical cheese bands have a width of about 8.89 cm and a thickness of about 0.32 cm. The packing foil 504 comprises an outer layer of a relatively thermoimpermeable plastic compatible with foods, such as, for example, polypropylene or a polyester polymer, and an inner coating of a relatively low-melting closure material, such as, for example, polyethylene or a polyethylene copolymer compatible with foods. The foil tube edges overlap preferably in longitudinal direction at their corresponding ends or can be locked lying one on another in the initial formation of the wrapped cheese band 12.

Although spreading cheese is ordinarily extruded at high temperatures, the wrapped cheese band 12 is preferably cooled in a suitable manner to room temperature or below (for example, 12.78°C to 21.1°C) before the transverse closing. Such a cooling improves the strength of the cheese band and makes it more difficult to remove it from the closure zone, whereby the advantages of the closure system described are increased.

The term "plastic" as it is used in this context covers likewise viscose materials that have no defined tension-expansion limit but are difficult to remove from the closure zone. Preferably the form of execution described uses spreading cheese, it being possible, however, likewise to use other plastic foods, such as, for example, natural cheese sorts, cheese foods, synthetic cheese and meat emulsions.

The cheese band 12 wrapped in longitudinal direction can be fed from one or more suitable directional and/or cooling rollers (not shown) and brought into the apparatus 16 for the closing. The closure apparatus 16 comprises two oppositely lying rows 18, 20 of closure elements and support elements, respectivel which are joined with one another by means of belts, which are driven uniformly at a relatively high speed. In the closure strip belt series 18 several closure strips 200 (see Fig. 2) are joined alternately with flat plates 22 as an endless band. In the support series 20 several spaced, elastomer support parts 600 (Fig. 6) are separated in a similar manner by means of flat plates 22 and joined in the form of an endless band of essentially the same length. In the form of execution 10 represented, th closing

element band series 20 comprise twenty-six support parts 600 and twenty-six plates alternately arranged therewith. Only a limited number of the corresponding closing strips and support parts with the corresponding bands 18 and 20 is represented in Fig. 1, while normally these elements are arranged regularly and continuously along the entire length of the bands. The closing strips and closing elements 200 and the elastomer support parts 600 are spaced in correspondence to the desired length of the finished product packings, and aligned opposite one another by means of a suitable drive which comprises the drive elements 23, 24 for the corresponding bands 18, 20. In operation the closing strip band 18 and the support part band 20 are driven in such a way that the foil-wrapped cheese band is drawn through in the direction represented by the arrow in Fig. 1 in between. The bands 18 and 20 are held with respect to one another and at a suitable pressure so that the corresponding oppositely lying closing and support elements 200, 600 are pressed against the interlying foil-wrapped cheese band 12 with a contact pressure in the range from about 10.5 kg/cm^2 to about 42.18 kg/cm^2 of the contact surface, the range preferably extending from about 17.575 kg/cm^2 to about 28.12 kg/cm^2. In the form of execution 10 represented, approximately six closing-support parts of the corresponding bands 18, 20 stand in such a pressure contact, in which various additional closing-support pairs on the input and output side(s) of the bands 18, 20 are subject to a corresponding pressure action and pressure release.

As already mentioned, the surface provided with very small transverse channels of the closing element, is an important feature of the invention. In the following, therefore, the closing element used in the apparatus 10 is to be described in detail. The closing element 200 is represented in perspective in fig. 2. The closing element 200 represented comprises a body 204 with a substantially flat contact surface 206, which in the form of execution represented has a width of about 1.19 cm and a length of about 25.4 cm in the direction of the longitudinal axis. The whole body of the closing element 200 consists of a relatively hard metal material, such as, for example nickel-steel. The element 200 can be fastened to the conveyor band 18 of the closing apparatus 16 by means of the fastening openings represented and heated to the desired transverse closing temperature by means of a suitable resistance heating device which is arranged inside the recess 208 of the sides of the closing element joined with the band.

The closing surface 206 of the element 200 comprises a substantially flat level surface 210 in which there are made several rows 212, 214 of regularly spaced recesses. The recesses represented comprise a first set of notches or channels 212 which have a depth of 0.254 mm with a spacing from center to center of 0.889 mm. The grooves 212 have a section angle 216 of 45° with respect to the longitudinal axis of the closing element 200. The grooves are incised at 60° along the channel direction. A second set of grooves 214 cutting the first grooves, which are essentially regularly spaced in the same manner are about 0.254 mm deep, with a center-to-center spacing of 0.889 mm.

They are likewise incised at an angle of 45° with respect to the longitudinal axis of the closing elment 200 and have a section angle of 60° along the channel direction. The grooves 212 and 214 are arranged, therefore, about at an angle of 90° to one another, in order to form an arrangement of regularly spaced, separate, narrow closing surfaces 212 which are arranged between the groove series 212, 214. In this respect, over about one hundred twenty-four separate closing surfaces 210 are formed per cm^2 of the closing element surface by means of the channels 212, 214 connected with one another. The channels 212, 214 create likewise series of channels joined with one another for the removal of the cheese from the longitudinal center line of the closing element in longitudinal direction and in axial direction to the outer longitudinal edges of the closing strip when the closing strip cooperates with the support part 600 of rubber.

As represented in Fig. 6, the support part 600 comprises an elastomer body 602 with a convex closing surface 604, which is constructed in arcuate form in one direction of the longitudinal axis of the support part 600, so that with a pressure against the foil tube 12 the cheese is continuously removed from the middle of the closing zone in general laterally to the contact force.

At least the surface part of the elastomer support part 600 which lies opposite the closing element 200 in the compressing of the foil tube 12 should consist of an elastomer material. Ordinarily such support parts consist of an elastomer material, such as, for example, a polyurethane elastomer with a Shore A hardness of about 70 to 90. By the providing of the curved

surface 604 of the support part the pressure is inially brought up at a middle contact points with the foil tube containing the food, so that the food is brought outward from the contact line when the support element is further pressed against the closing element. Fig. 5 shows the form of the food-containing foil tube, of the closing element 200 and of the support element. It is further assumed in this regard that the elastomer property of the support element presses the foil layers at least partially into the channels 212, 214 of the closing element, whereby the foil is drawn, and the product contained in between is pumped through the channels into the packing zone. The closing elements 200 are held at a predetermined raised temperature that is suitable for the closing of the thermoplastic foil layer under the time-pressure conditions that are used in the process. Usual heating elements and control devices (not represented) can be used for this purpose. In the form of execution represented the closing element temperature can be kept within a relatively low temperature range of about 93.32 to about 121°C.

The closing element band 18 and the oppositely lying support part band 20 can be driven at a relatively high speed, for example at least at about 30.48 m/min., whereby there is yielded a contact time with the form of execution 10 represented of the closing elements 200 at a maximal pressure of about one second or less. Correspondingly, the removal of the food and the closing of the inner surfaces of the packing material must be carried out in a limited time. Ordinarily the device 10 is driven at a rate of about 61 m/min., whereby there is yielded a corresponding contact time at maximal pressure for the foil band of about 0.5 seconds. When the

band runs through the closing system 16 a closing element of the closing band 18 and a correspondingly aligned oppositely lying elastomer support part of the support part band 20 are brought into contact with the cheese band, in which process gradually the plastic cheese is pressed out of the zone separating the elements when they are brought together by means of the bands 16, 18. Since the surface of the support part 600 is convex, the cheese is gradually led away from the initial contact point of the curved elastomer support part 600, until the closing elements and the corresponding oppositely lying support elements 600 are pressed with maximal pressure against the interlying packing foil. The band of the closing elements 200 and the band of the corresponding support elements is guided against corresponding pressure plates in order to develope a lasting pressure between them. The flat elements 22 are arranged at a predetermined spacing which corresponds to the desired thickness of the individual cheese packings to be packed. The closing element and the corresponding elastomer support part are gradually brought toward one another and are pressed against one another for the duration of the run-through of the closing element 16, where the bands, by means of a similarly inclined cam plate gradually separate the closing elements and the support parts, in order to return them to the upper section of the closing station, where they again pass into engagement with the packed cheese band in the vicinity of the entrance to the closing apparatus.

After the emergence from the output end of the closing station 16 the foil is closed at intervals in transverse direction, which correspond to the spacing of the closing elements 200 and the oppositely lying support parts 600 of the bands 18, 20. The continuous cross-closed foil 26 formed thereby is fed thereupon to a cutting station 30, which is of usual construction type, in which the foil 26 is cut about in the middle of the transverse closure in order to obtain individual packages 32. The closing station 16 and the corresponding cutting station 30 can be driven at a relatively high speed in order to produce individual packed food slices with cross-closures of desired uniform strength and unity. The cross-closure can be opened continuously uniformly by the user, thu an irregular tearing-open, a stepwise tearing open, is prevented. In the form of execution represented, at the closing station about ten closing elements stand in contact with the band, there being maintained the maximal pressure about over a length of 101.6 cm. At an operating speed in the range of about six hundred packings per minute this corresponds to a maximal pressure time of less than about 0.5 seconds for each transverse closure. By increasing the depth of the closing station 16, several foil tubes 12 can be processed, whereby the production amount of the individually packed packages 32 is multiplied.

With the closing process of the invention and the corresponding apparatus there is created a dependable, easy-to-open closure, the

problem of escape of the cheese and of uneven closure being solved. The process and the apparatus make possible, further, an improved productivity and a reduction of the reject. Further, an adhesion of the foil to the rubber of the support part by reason of the lowered closing temperature is reduced, or excluded, whereby a dependable removal of the cheese from the closing zone is made possible. By the use of the grooved surface of the closing part through the formation of extremely small transversely running channels, there is further made possible a substantial lowering of the closing temperature of the closing elements, whereby there is made possible a dependable operation at high speeds for the most diverse types of packing foils, which previously were not possible to use for such packings.
